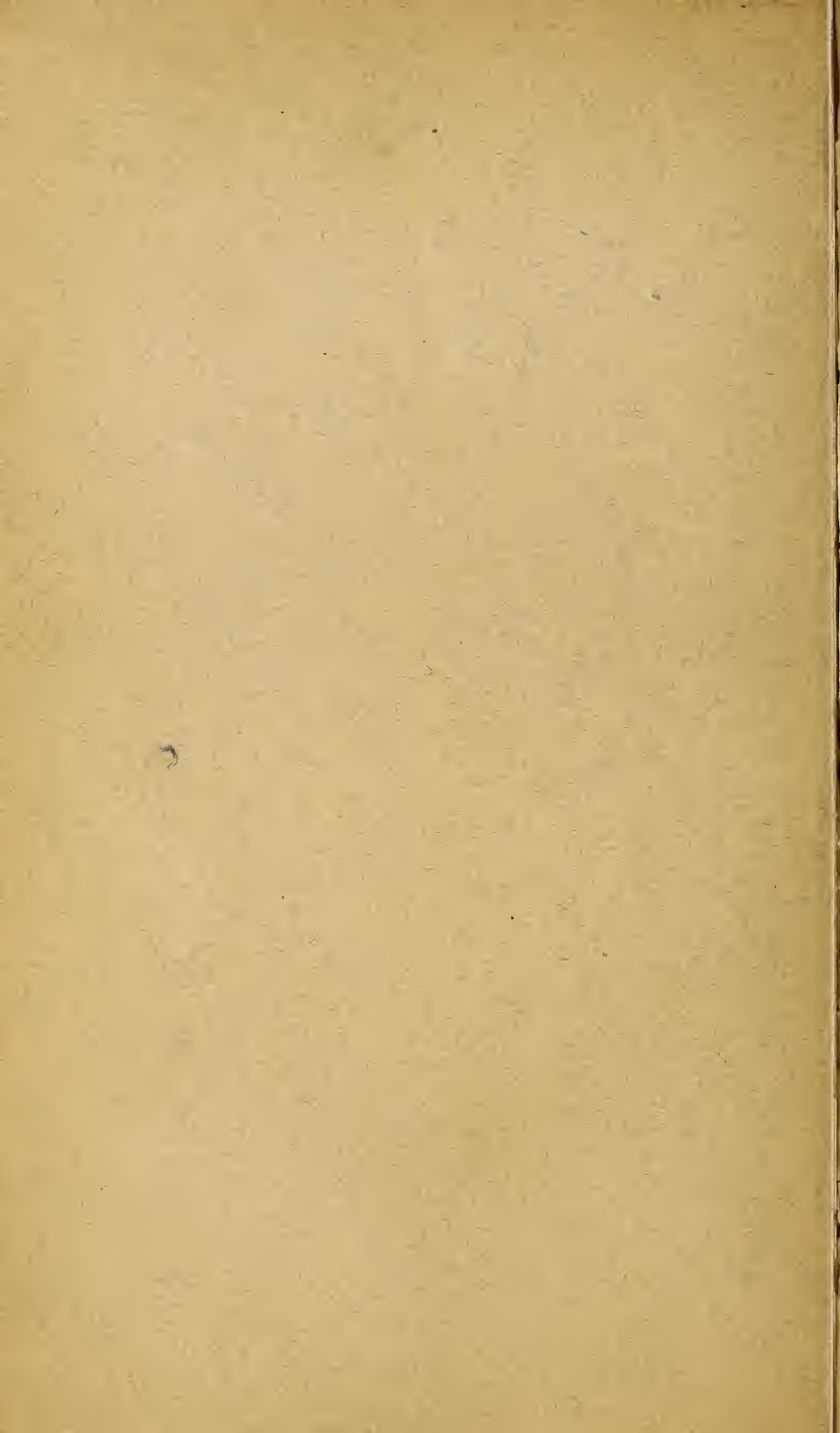


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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 175.

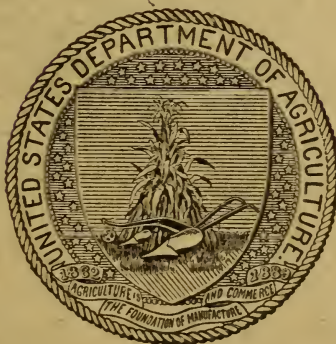
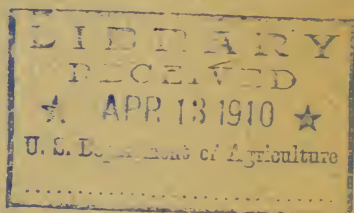
B. T. GALLOWAY, *Chief of Bureau.*

THE HISTORY AND DISTRIBUTION OF SORGHUM.

BY

CARLETON R. BALL,
AGRONOMIST IN CHARGE OF GRAIN-SORGHUM
INVESTIGATIONS.

ISSUED APRIL 8, 1910.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1910.

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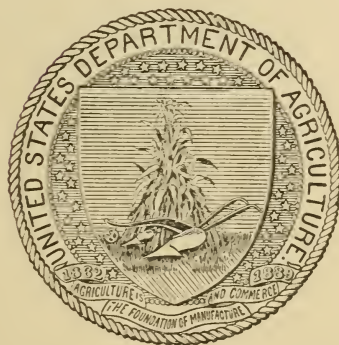
B. T. GALLOWAY, *Chief of Bureau.*

THE HISTORY AND DISTRIBUTION OF SORGHUM.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., December 18, 1909.

SIR: I have the honor to transmit herewith a paper entitled "The History and Distribution of Sorghum." by Mr. Carleton R. Ball, Agronomist in Charge of Grain-Sorghum Investigations, and recommend its publication as Bulletin No. 175 of the series of this Bureau.

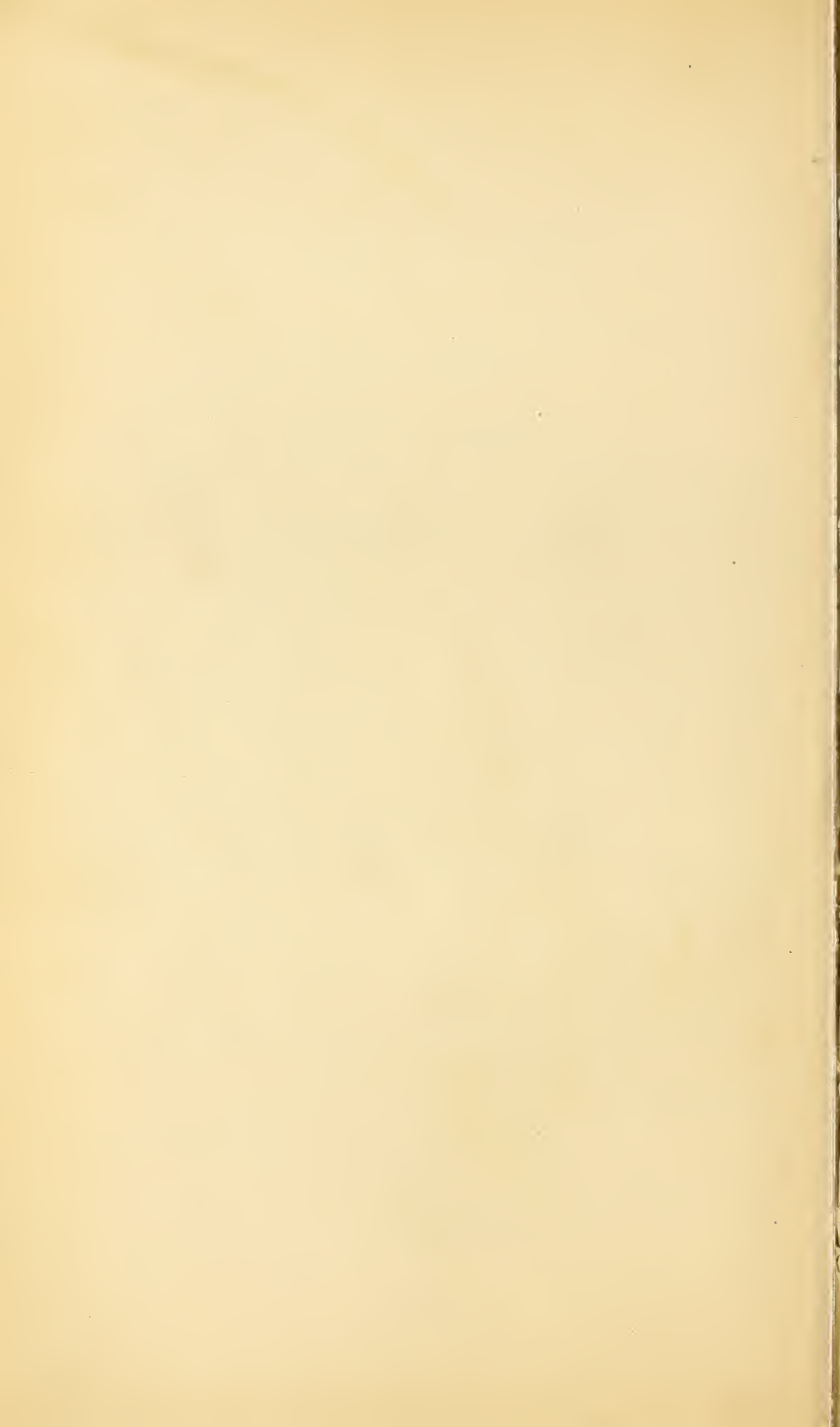
The facts stated in the paper have been developed in connection with a study of the agronomic adaptations of over 1,000 varieties of domestic and foreign sorghums. Data concerning the geographical distribution of the sorghum plant and the leading types which are found in different regions of the earth are here presented for the first time. Sorghums have been very extensively used as human food in Africa and the Orient for more than twenty-five centuries. Some of them are now important grain and forage crops in large areas of the western United States, and have been found adapted to a much wider range of climatic and soil conditions than was formerly thought possible. A knowledge of their distribution and adaptations in their native lands will be of value to all agronomic workers and others concerned in the improvement of these crops.

The author wishes to acknowledge his obligation to Miss R. M. Kolck for assistance in the translation of the Latin works; to Miss A. R. Knapp for the translation of the Italian article by Arduino; and to Miss M. F. Warner for aid in securing and citing many old and rare botanical works.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.



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THE HISTORY AND DISTRIBUTION OF SORGHUM.

INTRODUCTION.

Certain sorghums now hold a large and increasingly important place as grain and forage crops in the semiarid regions of this country. They were all introduced into the United States between twenty and thirty years ago. Few data were secured concerning their habits and adaptations in their native lands, and many valuable years of time and effort were lost in attempts to grow them successfully in regions to which they were not at all suited.

During the past six years more than 1,200 different lots of domestic and foreign sorghums have been brought together and grown experimentally. By far the greater part of these were from foreign sources—principally from Africa and southern Asia. In most cases only meager information was obtained regarding the conditions under which they had been grown or to which they are most probably adapted in this country. For these economic reasons and because of the bewildering diversity of forms secured it became necessary to inquire at some length into the whole question of the origin and history of this group of cultivated plants. This paper embodies the results of the investigation. The origin and antiquity of sorghums are set forth, together with their present distribution and culture. The chief types or groups now found in each of the major geographical areas are briefly described, the conditions under which they have developed are pointed out, and their probable adaptations in our own land are indicated.

The term "sorghum" is used here in the broad and comprehensive sense. It thus includes all the groups popularly known in this country as sorgo or sweet sorghum, kafir, broom corn, shallu, kowliang, durra, and milo. It covers also an enormous number of cultivated forms in other lands with the possible exception of a few, which, as pointed out in the discussion of botanical history, may perhaps be referred to *Andropogon halepensis* rather than to *A. sorghum*. For the convenience of readers not familiar with the sorghums, a rather

full key to the principal groups is inserted here. A complete classification of the domestic varieties is in preparation.

KEY TO THE PRINCIPAL GROUPS OF SORGHUM.

The following is a key to the principal groups of sorghum:

I. Pith juicy.

A. Juice abundant and very sweet.

1. Internodes elongated; sheaths scarcely overlapping; leaves 12-15 (except in Amber varieties); spikelets elliptic-oval to obovate, 2.5-3.5 mm. wide; seeds reddish brown. I. *Sorgo*.

B. Juice scanty, slightly sweet to subacid.

1. Internodes short; sheaths strongly overlapping; leaves 12-15; peduncles erect; panicles cylindrical; spikelets obovate, 3-4 mm. wide; lemmas awnless. II. *Kafir*.
2. Internodes medium; sheaths scarcely overlapping; leaves 8-11; peduncles mostly inclined, often recurved; panicles ovate; spikelets broadly obovate, 4.5-6 mm. wide; lemmas awned. VII. *Milo*.

II. Pith dry.

A. Panicle lax, 2.5-7 dm. long; peduncles erect; spikelets elliptic-oval or obovate, 2.5-3.5 mm. wide; lemmas awned.

1. Panicle 4-7 dm. long; rhachis less than one-fifth as long as the panicle.
 - a. Panicle umbelliform, the branches greatly elongated, the tips drooping; seeds reddish, included. III. *Broom corn*.
2. Panicle 2.5-4 dm. long; rhachis more than two-thirds as long as the panicle.
 - a. Panicle conical, the branches strongly drooping; glumes at maturity spreading and involute; seeds white or somewhat buff. IV. *Shallu*.
 - b. Panicle oval or obovate, the branches spreading; glumes at maturity appressed, not involute; seeds white, brown, or reddish. V. *Kowliang*.

B. Panicle compact, 1-2.5 dm. long; peduncles erect or recurved; rhachis more than two-thirds as long as the panicle.

1. Spikelets elliptic-oval or obovate, 2.5-3.5 mm. wide; lemmas awned. V. *Kowliang*.
2. Spikelets broadly obovate, 4.5-6 mm. wide.
 - a. Glumes gray or greenish, not wrinkled; densely pubescent; lemmas awned or awnless; seeds strongly flattened. VI. *Durra*.
 - b. Glumes deep brown or black, transversely wrinkled; thinly pubescent; lemmas awned; seeds slightly flattened. VII. *Milo*.

AGRICULTURAL HISTORY AND DISTRIBUTION OF SORGHUM.

ORIGIN.

It is generally conceded that cultivated sorghums were originally derived from the well-known wild species, *Andropogon halepensis* (L.) Brot. Prof. E. Hackel (1885) has presented this theory at length, and it is not necessary here to examine his able argu-

ment. The wild species is found abundantly in all tropical and subtropical parts of the Old World (fig. 1). It has been quite carefully studied by agriculturists and botanists in India, and to a lesser extent in tropical Africa. Its forms are numerous and the

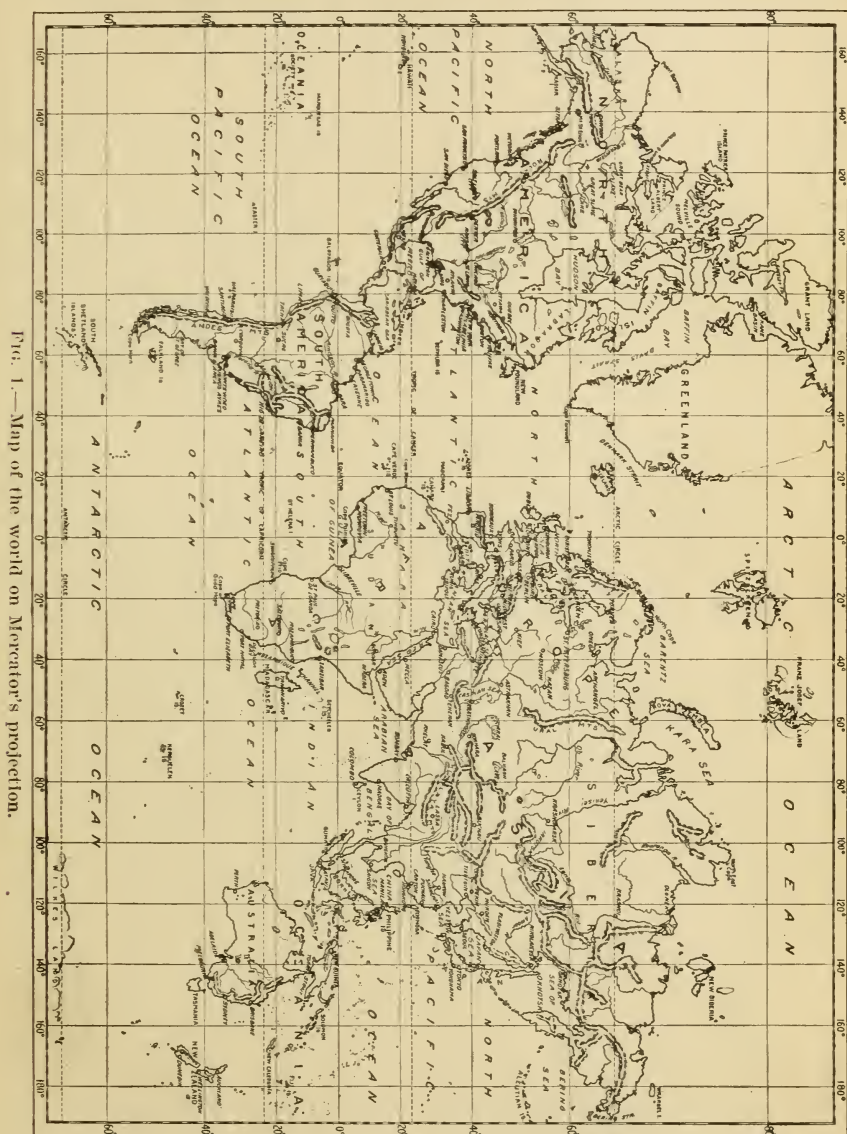


FIG. 1.—Map of the world on Mercator's projection.

main lines of variation are parallel with those represented by the major groups of cultivated varieties. This is especially noticeable in comparing the forms assumed by the wild and the cultivated species in Africa, and to a lesser extent in India also. The abundant

variation of the wild species, the great number of different cultivated forms, and, with few exceptions, their evident dissimilarity in the two regions argue for the independent origin of the cultivated species on the two continents. This view has gained wide acceptance in later years. In the discussion of geographic distribution this theory is recognized as the probable one.

ANTIQUITY.

There can be no doubt of the great antiquity of the sorghum plant in cultivation. The story of its domestication is lost in the shadows of the past. From Egypt, the cradle of ancient agriculture, comes the earliest known record of its use. A harvest field frescoed on the walls of the tomb of Amenembes in Beni-Hassan, belonging to a dynasty existing at least 2,200 years before Christ, is said by Wönig^a (1886) to represent a form of sorghum. This crop is still important in the land of the Nile. In the book of the prophet Ezekiel (600 B. C.) the word "millet" is translated "dochan" ("dochn" or "dokhn") in the original Hebrew text. This word is still used in Arabic for forms of sorghum and also for some of the larger millets, such as pearl millet (*Pennisetum spicatum*). The root word also means "smoke" in Arabic, and the name may be more correctly applicable to pearl millet, with the seeds sometimes smoke colored, than to sorghum. If it here refers to a grain-bearing sorghum, this crop was well known in the fertile and irrigated valleys of the Tigris and Euphrates more than 600 years before the present era. It is known that a sorghum with white and flattened seeds was cultivated in Arabia as early as the tenth century. A very similar white durra is still abundantly grown in Syria and Mesopotamia, and forms a considerable part of the food of the poorer classes.

Little light can be thrown on the early history of sorghum in India. The Roman historian Pliny records the introduction of sorghum into Italy by caravans from India during the first century. How much longer it had been cultivated in India is not certain, nor can we be entirely sure that the record of the Roman historian is correct. Caravans coming from India then, as now, passed through Upper Egypt, and the sorghum supposedly brought from India may possibly have been an Egyptian variety used as food in the last stages of their journey. The great antiquity of sorghum culture in India is, however, assured from other sources. According to Benson and Subba Rao (1906), the plant is mentioned in one tale dating from more than 1,900 years ago. It is spoken of by many other writers of early times and bears a Sanskrit name—Yava-nala (reed barley or reed grain).

^a Where only year and page are given, see chronological bibliography at end of bulletin for full citation.

It is very extensively cultivated, with a multitude of varieties and names, throughout the major part of India, especially in the interior in native states, which have had only a limited intercommunication. There are some important religious ceremonies observed in connection with its sowing and harvesting. These facts all point conclusively to its cultivation there from a remote period.

In China there is evidence, according to Bretschneider (1893), that sorghums were first known there in the third century A. D. There are numerous doubtful references of earlier date which may apply either to sorghum or to the true sugar cane. As early as some of the ancient classics there is found mention of a black millet which bore two seeds in each spikelet. So far as the writer is aware, there are no two-seeded varieties known either in *Panicum miliaceum* or in *Setaria (Chaetochloa) italica*. Several varieties of what may be called "twin-seed" sorghums are known in India. Some of these have black and shining glumes, and it is quite possible that the writer of the ancient classics referred to such forms of sorghum. This is the more probable since it is most likely that China received her sorghum varieties from some part of the Indian Empire.

These isolated records all indicate an early and extensive domestication of this plant. The same conclusion may be deduced from a study of the present distribution of the cultivated varieties.

GEOGRAPHICAL DISTRIBUTION.

Originating in the Tropics of the Old World (fig. 1), sorghums are now grown in the Temperate Zones of both hemispheres. The bulk of the crop is grown between the parallels of latitude 40° north and south. In the United States and in Manchuria the sorghums are found as far north as latitude 45° or more. The two great centers of the cultivation of sorghum for human food are Africa and India. In both regions it is the staple farinaceous food for a considerable part of the population. The distribution of sorghum in India is discussed in its proper order. A word on some of the general aspects of its occurrence in tropical Africa (fig. 2) may be in order before the discussion of individual regions is begun.

The absence of permanent records among the African tribes from the Sahara southward nearly to the Cape makes futile any attempt to study the history of sorghum among them. For many tribes it is, however, the most important food plant and is also commonly used in the manufacture of a fermented drink. The widespread dispersion and cultivation of sorghum among these tribes and their great dependence upon it for food point to its ancient origin and domestication. Still more striking testimony is the extreme richness of the varieties and forms which it presents. These are by no

means adequately known, but it seems likely that they will easily outnumber the combined total from all other parts of the world. Most of them belong apparently to groups which are found sparingly or not at all elsewhere. Such a profusion of forms of a cultivated plant among primitive peoples must have required many centuries for derivation and development. Not only the names, but the actual varieties also are often quite different in separate, though adjacent,



FIG. 2.—Map of Africa. (Scale 1,200 miles to the inch.)

tribes. The women of a tribe, who are commonly its laborers, often become quite expert in distinguishing closely related varieties—a knowledge to which the men seldom attain. Their methods of cultivation are necessarily crude, but through the accumulated wisdom of many centuries of cultivators they have amassed a great deal of accurate information about the handling of the crop. How it responds on different soils and in different seasons, the proper dis-

tances for planting the hills of different varieties, how and when to harvest, and how best to cure the seed, as well as considerable skill in preparing different articles of food from it, are matters of common knowledge among the older members of various tribes. Of the numberless varieties grown by tribes throughout the length and breadth of tropical Africa, only the sweet sorghums and kafirs from the region of Natal and the Orange River Colony have ever been brought under cultivation in this country.

SOUTH AFRICA.

That portion of the great tropical continent known as South Africa includes the British areas of Cape Colony, Natal, Orange River Colony, Transvaal, and Rhodesia; also German Southwest Africa and parts of Portuguese East Africa and the Portuguese territory of Angola on the west coast. It is not known if sorghums are grown in the German and Portuguese territory on the west side and little is known of the varieties found in Portuguese East Africa. The forms of British South Africa have been quite fully studied. Much of this area is a more or less dry and elevated plateau, an ideal place for sorghums. Two of the principal groups, sorgos (sweet sorghums) and kafirs, are found here in the greatest abundance and diversity. They require but little selection to make them suitable for use in America because of the similar conditions obtaining in the two regions.

NATAL.

Natal, the smallest division of South Africa, lies in the southeastern part of this great region, its coast washed by the Indian Ocean. Only two sorghum groups, sorgos and kafirs, appear to be native to this little state or extensively grown therein.

In Natal the sorgos are cultivated by the natives for forage and for the sweet juice, which they express by chewing the peeled stalks. It was from Natal that sorgos were introduced to Europe and America. From Natal, Arduino obtained, about 1775, his *Holcus cafer*, which was apparently very similar to our Planter sorgo. From Natal, Wray secured, in 1853, the sixteen saccharine varieties from which have descended most of the sorgos now cultivated in Europe and the United States. Several importations of sorgo varieties were made from Natal in later years, but no systematic comparison of the resulting plants was ever undertaken. It is therefore not known how many different varieties have been found there up to the present time. Some varieties recently obtained are proving distinct from any forms now grown in this country.

The kafir group is probably native in Natal, though the varieties first domesticated in America were brought from the Orange River Colony. Within the past few years forms very similar to our black-hull and red kafirs have been secured in Natal. With these have come a number of other forms varying mostly in the size of the head and

in the size and color of the seeds and glumes. Some forms of the *Roxburghii* group are occasionally found in Natal, but are apparently introduced from Madagascar, from the regions north of the Zambezi River, or from India.



FIG. 3.—Heads of four kafir varieties. *a*, White kafir; *b*, Guinea kafir; *c*, blackhull kafir; *d*, red kafir.

ORANGE RIVER COLONY.

Our widely grown and valuable kafir varieties came from the former Orange Free State about thirty years ago. From that first importation three varieties resulted, the white, the blackhull, and the red kafirs (fig. 3), of which only the last two are now cultivated in

the United States. Recent importations from British South Africa, principally from this colony and Natal, reveal the presence of a great number of similar forms throughout the eastern portion of South Africa. They are all undoubted kafirs, differing from our three varieties in minor details, such as size and height of the stalk, length of the head, and size and color of the seeds and glumes. Many of these forms have larger seeds than had the forms first imported. No new colors in seeds have been found, but only varying shades of red and pink. Their variation in much more narrow limits than the sorgos may indicate a more recent origin.

TRANSVAAL AND RHODESIA.

A few kafir forms have recently been obtained from the colonies of Transvaal and Rhodesia. It is probable that when northern Rhodesia has been more fully explored that varieties similar to those of equatorial Africa will also be found.

MADAGASCAR.

The large island of Madagascar, more than a thousand miles long, lies off the east coast of South Africa at a distance of 300 to 500 miles. Its sorghums are naturally not well known, but the few that have been obtained, under the native name of Mpemby, are freely stooling and very leafy sorts, with loose open heads bearing white or reddish-brown seeds.

The panicles vary much in shape, some being oblong or narrowly oval, others short and fan shaped, while still others are much elongated and trumpet shaped. The branches of the head are always long, slender, repeatedly divided, and often drooping. (Fig. 4.) The spikelets are slender, acute, and prominently



FIG. 4.—Plants of shallu, representing the variety *roxburghii*, Hackel.

awned. These forms belong, apparently, to the variety *roxburghii* Hackel, together with the shallu of India and some of the forms of the Guinea coast, under which heading this form is more fully described. Similar forms are found occasionally in Natal, where they are apparently introduced rather than native. All these varieties are very late and are apparently adapted only to our Southern States, if at all.

EQUATORIAL AFRICA.

But little is known of the sorghums of equatorial Africa, an immense region which includes roughly about ten degrees of latitude on either side of the equator. They seem to be but little grown in the French and German Kameruns on the west coast. Almost nothing is known of their occurrence in the great interior Kongo State. On the east side, however, it is known that the sorghums occur in extremely numerous and variable forms.

GERMAN AND BRITISH EAST AFRICA.

A considerable number of sorghums have been secured from German East Africa and British East Africa, lying immediately south and north of the equator, respectively. Naturally they have not matured at any of our testing stations in this country, and hence there has been but little opportunity to study them fully at first hand. Many of them certainly represent entirely new groups of sorghum. One of the most promising of these groups stands in some respects in a position intermediate between the sorgos and durras. Some of the varieties represent a northward extension of the kafir group. All are grown for human food and for forage.

SUDAN.

The Sudan has a breadth north and south of about 1,000 miles and an extension east and west of about 4,000 miles. It includes, in its western part, the French Sudan and the numerous small colonies of the Upper Guinea coast. The principal ones of these are, from west to east, Senegal and French Guinea, once known as the Kerry Coast; Sierra Leone and Liberia, the old Grain Coast; the Ivory Coast, now a French colony; the Gold Coast, now a British colony; and finally Togoland, Dahomey, and Nigeria—German, French, and British colonies, respectively, together comprising the Slave Coast. The eastern part of the Sudan is included in the British-Egyptian Sudan, to the east of which lies Abyssinia. The coastal region is tropical and humid, the interior in large part hot and with little rainfall.

FRENCH SUDAN.

Very few sorts have yet been obtained which are known to have come from the interior of the French Sudan. These few do not differ, so far as can be determined by the seeds and glumes, from

the groups found farther south in the various colonies of the Guinea coast. However, it seems not improbable that more extensive exploration may discover, in the dry, hot territory forming the southern border of the Sahara, other varieties adapted to our western plains.

UPPER GUINEA.

Varieties have been obtained from Senegal, French Guinea, Ivory Coast, Gold Coast, Togoland, Dahomey, and Nigeria. The leading group is one with large, oval, flattened seeds, varying in color from white through pale red to deep reddish brown: red, brown, or black glumes, and semicompact heads. A striking peculiarity is the lateral rotation of the seed in the glumes at maturity, the axis of the movement being a line from the hilum to the apex of the seed. This movement of the seed is apparently characteristic of the whole group, which includes Hackel's variety *oculifer* and probably some other botanical varieties. The different forms in this group all have the appearance of being good grain producers. An effort should be made to find some suitable for cultivation in this country. Those heretofore secured are much too late for any but tropical regions.

Another sorghum group found in this region is closely related to the shallu (fig. 4) of India, and probably represents Hackel's variety *roxburghii*. It is characterized by rather slender stalks, loose, open, pyramidal heads with more or less drooping branches, small, oval seeds, and slender, acute glumes, which spread apart and become involute at maturity, completely exposing the seeds. One of these varieties from Senegal, called by the French "Mil Cigne," is apparently meeting with some favor at the Florida Agricultural Experiment Station. It seems adapted as a combined forage and grain crop.

BRITISH-EGYPTIAN SUDAN.

A recent importation of several varieties from the region of Khar-tum shows that the leading varieties are of the durra type found in Lower Egypt, some of the varieties being identical. The seeds average smaller, but this may be due to the less luxuriant growth of the Sudanese plants. Besides the usual forms with white, pale-yellow, and pale-brown seeds, there is one with gray seeds. This last variety has proved quite early and a fair yielder, and may ultimately become a profitable crop in the United States. The seeds tend to become white under our climatic conditions. The other varieties are now being grown for the first time, and their maturity will be watched with interest in the hope of finding some of value.

ABYSSINIA.

The sorghums of Abyssinia are yet but little known. In a considerable collection of the seeds sent from that country to France in 1840

it is reported that a large number of varieties was found. Some of them were full of very sweet juice, some but slightly sweet, and others not at all so. Their other varietal characteristics were not indicated. Very meager data have accompanied the few shipments of seed received in this country from Abyssinia. Most of the varieties are



FIG. 5.—Plants of an Abyssinian sorghum not yet headed.

apparently very late, and only occasionally can one be brought to the flowering stage, and none to maturity, in the United States. Most of them are very tall and stout (fig. 5) and of apparent kinship with the larger varieties of India. Some are shorter and freely stooling, though with stems of enormous size. The mixed seed in one lot are apparently identical with those of the yellow and brown durras (safra and ahmar) of Egypt. Many of the sorts introduced have apparently been badly hybridized. None of them give promise of being of any value, unless for silage and fodder on the Gulf coast. Since the interior of Abyssinia

is a high and dry plateau, it may be that varieties suitable for our high plains will yet be discovered there.

NORTH AFRICA.

Northern Africa may be separated into two regions, in each of which sorghums are grown to a considerable extent for human food.

These regions are (1) Egypt and (2) the Barbary States. The varieties found in each are different, and also differ from those of equatorial Africa.

EGYPT.

In Egypt, durra is used as a general term to designate all succulent forage. All sorghums are called durra beladi to distinguish them from corn, durra shami. The fall-sown sorghum is called nili and the spring-sown, or common crop, sefi. The varieties with erect heads are called aym, those with pendent heads awagi. There are three sorghum varieties in common cultivation, all belonging to the spring-sown crop with erect heads, or the durra beladi sefi aym. The three are known as beda, or white seeded; safra, or yellow seeded; and ahmar, or brown seeded. Beda is grown more extensively than all the others combined. Where grown in this country all three are very tall and very stout forms of the durra group, 10 to 14 or more feet in height, with 20 to 30 leaves on each stalk. All possess larger seeds and more closely compact heads than are found in any other varieties of the durra group. They are of no apparent value for any part of the United States.

It is possible that safra, the yellow-seeded variety, was the foundation stock for the milo of this country. They are very much alike in both glume and seed characters, including the awns. These Egyptian forms, while larger in the size of plant and seed, are rather similar to some forms from Abyssinia and from India. The probable relationships of these sorts are more fully discussed under the heading "Botanical history." The groups of sorghum so common in central and southeastern Africa are not found in Egypt, with the exception of an occasional kafir in Upper Egypt, an evident stranger from the South.

BARBARY STATES.

In Morocco, Algeria, Tunis, and Tripoli, comprising the Barbary States, the leading variety of sorghum is a white durra (fig. 6, *b*), called bechna, or beshna, by the Kabyles of Algeria. It is practically identical with that introduced into this country as Egyptian corn, known later as rice corn, and more recently as Jerusalem corn. It is probably not indigenous to North Africa. A very similar white durra is found throughout Turkestan, Mesopotamia, Syria, and Arabia, and the North African plant is probably a result of the Arab invasion of that region in the third century. There is also found sparingly among the mountain tribes, or Kabyles, of Algeria and in certain oases in the northern Sahara a red-seeded durra very similar to our brown durra and very likely the original form of it. This form has not yet been found in Arabia or elsewhere in southwestern

Asia. The physical and climatic features of the two regions are quite similar, and the almost complete absence of any other forms has prevented much hybridization. For that reason there has apparently been but little change in the varieties in many centuries.

The climate of much of this North African region is dry and hot. The white durra when grown in our Western States is very early and drought resistant and likewise a fair yielder. Its chief faults are the pendent heads of most strains and the freely shattering seeds. The shattering habit does not seem to yield to continued selection. If a strictly nonshattering strain could be found in North Africa, it would be of great value for our higher altitudes and latitudes. The brown

durra is an inferior sort and gives little promise, though it is also early and able to grow with little moisture.

SOUTHWEST ASIA.

White durra, the single variety found throughout the region of Asia Minor, Russian Turkestan, Syria, and Arabia (see fig. 6), has already been mentioned. In the southern part of this area it has certainly been grown for nine centuries, and probably



FIG. 6.—Plants of white durra from different countries, showing varying characters. The stalks in pairs, from left to right, are from (a) the United States, (b) Algeria, (c) Austria, (d) Turkestan, and (e) Syria, respectively.

ably for three times that period. The form commonly grown in these lands differs from that of North Africa and the United States in having the heads shorter and more compact and the seeds smaller, less flattened, and with less tendency to shatter. The heads of nearly all strains are persistently pendent or goose-necked. In parts of this region the white durra grows under exceedingly high summer temperatures. It is possible that very drought-resistant strains may be secured here. However, those brought from this region heretofore have not seemed to be more especially drought resistant than our best developed strains of kafir and milo. A nonshattering form of white durra from a dry, hot region would be of great value on our dry and windy plains.

The land tax levied by the Turkish Government is paid by the natives in the seed of this white durra. The people are required by the officials to present in such payments cleaned and selected seed, much better than the average found on the market or used in their homes for food. No other sorghums are found in all this great region except occasionally a little Amber sorgo introduced from Europe or America.

INDIA.

In the number of varieties of sorghum and the relative importance of the crop, India ranks second only to tropical Africa. The total area grown in India and Burma is now about 25,000,000 acres annually. Though cultivated for many centuries and forming a staple and very important article of human food and of export, Indian varieties have apparently not been selected or improved for grain production. The average grain yield obtained there would be considered very small in this country. According to the best statistics obtainable by the British Government and published recently, 10 bushels to the acre would seem to be a fair average for the grain yield of sorghum in India. Methods of cultivation are crude, and losses by drought, fungi, insects, and birds are considerable. It does not appear that the soil is especially poor, in spite of centuries of cultivation. This may be largely due to an abundant use of legumes, both as staple crops and as fillers or subordinate crops.

As noted, the number of varieties is very large. They vary in the different native states, and the names applied to them are much more numerous and variable than the forms themselves. Many of the varieties would be classed as durras, though none is identical with any of our cultivated durras. In color the seed of most of them is white or pearly yellowish, but in a few it is red. The heads, and the seeds as well, average quite small, though the plants themselves are usually both tall and stout (fig. 7). This is probably explained by the fact that in India the plants are always grown for both fodder and human food. Owing to their large size they are inclined to be rather late in maturing. A few varieties are dwarf in height, but these also have stout stems and mature with us scarcely earlier than the others. Rather compact heads and firm glumes are characteristic. One or two very large varieties are two seeded; that is, they have two fertile flowers and produce two seeds in each spikelet, instead of one, as is normal for the sorghums.

From more than 300 different lots of Indian origin, which have been studied by the writer, only one or two have seemed worthy of attempts at improvement. The small size and hard nature of the seeds would necessitate grinding to make them profitably available as stock food. To eliminate the large size of the stalk and bring the grain yield up to a profitable quantity would require several years

of careful selection. There is nothing in the appearance of the varieties to indicate that at the end of this period one might hope for anything better than, or even equal to, the best kafirs, white durra, and milo which we now possess. It should be possible to secure some excellent early and drought-resistant varieties in India by searching through the middle and northern parts of the Empire, as Berar, the Central Provinces, the United Provinces of Agra and Oudh, north to the Punjab and the frontier. Those previously introduced have come from the Madras and Bombay Presidencies.

Besides the durra-like forms, there are a few minor groups, of which only one needs special mention here. In all the writings on Indian agriculture concerning the sorghum crop there are references to a fall-sown, or rabi, crop. The great bulk of sorghums in India, as elsewhere, is sown in the spring and harvested in the summer or



FIG. 7.—Plants of different varieties of sorghum from India.

autumn. The rabi crop, on the contrary, is sown in September or October and harvested in the following February or March. From all available information this rabi crop is mostly composed of a single variety or group of very similar varieties, which is commonly called "shallu," or "shalu." Botanically these forms represent the variety *roxburghii* Hackel. The rabi crop is most largely grown in the Bombay Presidency, although not unknown in other sections of India. The shallus are characterized by rather slender stems, large, loose, and open panicles, and oval yellowish or straw-colored spikelets. The two indurated (empty) glumes spread wide apart at maturity and each becomes involute, thus leaving the white or pearly seed fully exposed. One variety of this group has been sparingly cultivated in our lower Plains region for several years and is now being carefully tested as a grain sorghum. (See fig. 4.)

A saccharine, or sirup-bearing, variety of sorghum is said ^a to have been largely grown locally for a long time at Bikanir, a point in northwest India, but seed of it has not yet been secured. A few saccharine varieties were introduced from this country into India thirty or more years ago, but did not prove popular in a country where the same variety is expected to supply both human food and animal forage. Amber and Collier sorgos, more or less pure, are still found there locally in very limited quantities.

The large varieties of Abyssinia seem to be very similar to, if not identical with, some of the larger India varieties, so far as one may judge from immature specimens of Abyssinian plants. Commercial intercourse between India on the one hand and Egypt and Abyssinia on the other has always been very free, and it would be surprising indeed if there had not been an interchange of the commonly cultivated crops. This may explain the similarity of some forms in the two regions.

There is abundant and quite conclusive evidence that cultivated sorghums have originated independently in India and in Africa. *Andropogon halepensis*, the presumable parent form, is abundantly distributed and highly variable in India. In some sections it is sparingly cultivated. In times of famine the seeds of this wild species are generally utilized for food. It has been suggested by agricultural writers of India that some of the forms now cultivated have been so recently and directly derived from *Andropogon halepensis* that they may still be referred to it rather than to *Andropogon sorghum*.

CHINA.

In China sorghum is called "kowliang" (fig. 8), or "tall millet," to distinguish it from the various smaller millets, species of *Panicum* and *Chaetochloa* (Setaria). All the forms studied by the writer, except the single saccharine variety, belong to a single related group of sorghums, which will henceforth be called the "kowliang group." Three varieties used as food have been distinguished: Brown kowliang, the most common one, with brown seeds and black glumes; blackhull kowliang, with white seeds and black glumes; and white kowliang, with white seeds and pale or greenish glumes. The stems are slender, usually quite dry and pithy, 4 to 11 feet in height, with oblong, somewhat open panicles 6 to 12 inches in length. Most of the strains secured have very tall stems, due apparently to the need of the Chinese to obtain as much fodder and fuel as possible with the grain. While none of the introduced strains are heavy yielders of grain, some of the dwarf forms are extra early and promise to be valuable as grain crops on our high plains if their productiveness can

^a Watt, 1893, p. 283; 1906, p. 111.

be sufficiently increased. A brown-seeded form with the panicle branches elongated is used for brooms and brushes.

This group is apparently confined to the northeastern part of China proper and to adjacent Manchuria, from latitude 38° to 41° north. In this region it is very important. The seed is used for human food, the stems and leaves for fodder, thatching, fences, and baskets, and

the stems and roots for fuel. Since *Andropogon halepensis* is not native in this portion of China, there is little probability of a Chinese origin for the kowliangs. They are not like any varieties so far found in India or in any other country. These facts seem to point to their introduction into China many centuries ago and their subsequent modification to the present forms. Since authentic references to a sorghum are found in Chinese literature at least as early as the third century A. D., this theory seems the most probable one.

In 1851 the seed of a variety of sorgo or saccharine sorghum was sent to France from the island of Tsungming (Chung-ming) in the mouth of the Yangtze River, latitude 32° north. From the brief and unsatisfac-



FIG. 8.—Plants of two varieties of kowliang from China.

tory descriptions and illustrations (fig. 9) of it published in France and in this country, we know that it had a tall and slender stalk, with about thirteen leaves, and a loose, conical panicle, with more or less drooping branches, and light-brown seeds completely enveloped in shining black glumes. These characters show that it was very similar

to some of our forms of Amber sorgo. Our Early Amber is said to have originated in 1859 as a sport in a field of Chinese sorgo growing in Indiana.

No other saccharine variety has been found in China. This one is said by Collins^a to be almost entirely restricted to the island of Tsungming, where it is cultivated as a delicacy for the Shanghai market, the sweet stems being eaten raw. The annual area sown on the island is only about 20 acres. Since the original importation in 1851 no seed, except that sent by Collins, was ever brought to the United States until May, 1908, when a few seeds (S. P. I. No. 22913), secured on the island of Tsungming, were received by the Office of Seed and Plant Introduction of this Department. These seeds were of poor quality and the resulting plants did not fully mature, but are apparently identical with some forms of Amber now grown in this country. There is, however, little doubt of the independent African origin of some Amber forms.

That form of kowliang which somewhat resembles broom corn is found also in Korea and Japan. It would be classed as very poor brush in the United States. Some improved broom corn is grown in Japan, but it is probably from seed originally secured in Australia, Europe, or the United States.



FIG. 9.—Plant of Chinese sorgo. (From Patent Office Report, 1854.)

PACIFIC ISLANDS.

The tropical islands of the Pacific show very few sorghums or none at all. Some of the larger islands, like Java, lying near the

^a Collins, 1865, p. 91.

continent of Asia, have one or two varieties, apparently of Indian or American derivation. In Australia the standard varieties are all importations from the United States. Numerous native varieties from India and the British colonies in Africa have been tested in Australia recently and a few are likely to persist in cultivation, at least for some years.

EUROPE.

Pliny (70 A. D.) records that a variety of sorghum was introduced from India into Italy about ten years previously. Its cultivation in Italy has apparently been continuous since the earliest introduction, and it was there that the name *surgo*, or *sorgo*, was first applied to the crop. In the extensive commerce of Greece and Rome with Africa and Asia it is probable that other importations of sorghum reached the northern shore of the Mediterranean Sea from time to time. By the end of the fifteenth century the cultivation of one or more forms of sorghum had become quite general in all of southern Europe from Greece to Portugal. It had also gradually extended northward to Germany (fig. 10),



FIG. 10.—Plant of sorghum, after Fuchs, 1542.

France, Belgium, Holland, and even to England. In these more northern countries it was probably grown as a curiosity in botanic gardens and did not always mature. It was generally known as Indian millet or reed millet to distinguish it from the smaller millets.

In southern Europe the seed at that time had come into common use for fattening pigeons and poultry and less commonly other stock. The forage, both green and cured, was used for various kinds of cattle, though it was early noted that animals sometimes died after grazing on the living plants. The seed was also commonly used in the making of bread by the poorer, or peasant, classes. This bread was brittle, dark colored, and more or less astringent. It was generally regarded as inferior in nutritive qualities to that made from the other millets, as *Panicum miliaceum* and *Chaetochloa* (*Setaria*) *italica*, or that from the larger cereals. The flour was also commonly made into a porridge with milk. The semisweet pith and sometimes the flowers were used in medicine.

The development of a broom corn from some loose-panicled sorghum took place in Italy more than two hundred and fifty years ago. Caspar Bauhin in 1658 states that the slender and very rigid dried heads were made into brooms by the Italians and used for brushing clothing in Italy, France, and also Germany. Ray in 1688 gives a full discussion of sorghum and records this use of the plant, stating that he himself had seen such brooms on sale in Venice. From just what form of sorghum this selection took place can never be known, but in figure 11 a loose-panicled form is shown, first pictured by L'Obel in 1576 and copied by Dodoens. Arduino in 1786 figures one more spreading than our Amber sorghum (fig. 12) and another with the rhachis much shortened (fig. 13), either of which would have been an excellent basis for broom-corn selection.

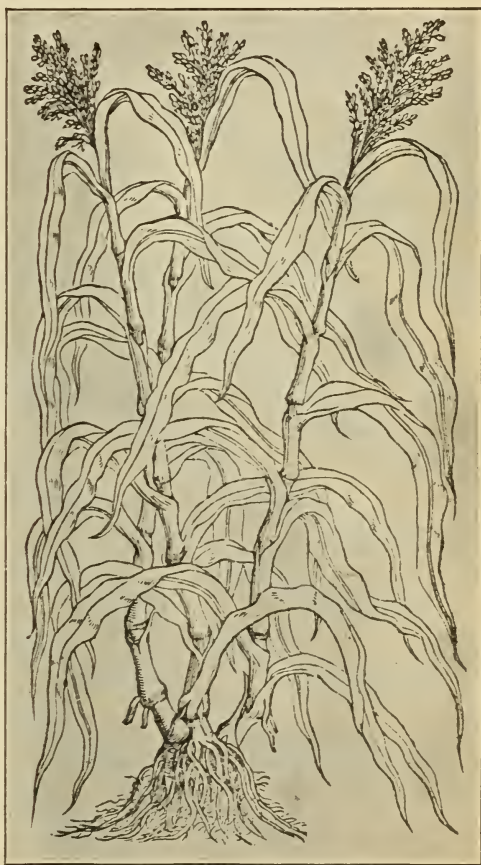


FIG. 11.—Plant of sorghum, after Dodoens, 1583.

The form introduced into Europe during Pliny's time seems to have been on the order of the sweet sorghums, even though it is not known to have had a sweet juice. It is noted as having stout culms, 7 feet high, and abundant black seeds, the color doubtless referring to the inclosing glumes. Most sixteenth to eighteenth century writers who mention these details describe this sorghum as having reddish seeds and black glumes, with culms from 7 to 10 feet or more in height and heads about 9 inches long. Many writers from the



FIG. 12.—Heads of *Holcus sorghum*, L., and *Holcus saccharatus*, L., after Arduino, 1786.

tenth to the eighteenth century describe also the white-seeded sorghum used by the inhabitants of Asia Minor, Arabia, and Mesopotamia, but none records its introduction into Europe. All references to its growth in Cilicia, or Sicilia (Sicily), are misprints for Cilicia. This form has been discussed under the heading "Southwest Asia."

About 1775 Arduino began at Padua, Italy, his experiments in sugar production from sorghums. He carried on this work for fully ten years, and in 1786 published a comprehensive paper in which

he described six supposed botanical species of sorghum and gave full notes on their culture and uses. He seems to have been the first author who gathered together and grew for a number of years all the forms he could secure. Of the six varieties thus described as species, one was a new sweet sorghum from "Cafreria" (Natal), South Africa, one was the white durra of southwestern Asia, and the other four were forms long cultivated in Italy. The six species were all splendidly illustrated on folio plates, which are here repro-

duced as figures 12 to 15. They were all commonly used for human and animal food, and the older ones were also used in the making of brooms. After Arduino's work ceased, for causes not explained, no especial attention seems to have been given to sorghum for sirup or sugar production until the middle of the eighteenth century.

In 1851 a saccharine sorghum from China arrived in France. It had been sent with many other seeds to the Royal Geographical Society by M. Montigny, the consul at Shanghai. It was obtained from the island of Tsungming (Chungming), lying in the mouth of the the Yangtze River, in latitude 32° north. A single seed is said to have germinated in the garden at Toulon, where the seed was sent. The resulting crop was secured at a high price by Louis Vilmorin, of Vilmorin-Andrieux & Co., well-known seedsmen of Paris. This seed, sold widely in Europe and afterwards in the United States, was the foundation of the variety long known as Chinese sorgo (fig. 9).

In March, 1851, Mr. Leonard Wray, an English sugar planter, arrived in Natal, South Africa. Soon after, his attention was attracted to numerous varieties of sorgo called "imphee," which the Zulus or Kafirs cultivated for the sweet stems. These people knew nothing of the art of expressing the juice by mechanical means, but simply chewed the peeled stems. After considerable search Mr. Wray succeeded in getting together sixteen varieties under their native names. These he brought to Europe about 1854 and arranged to



FIG. 13.—Head of *Holcus cafer*, after Arduino, 1786.

have grown in various countries. From these varieties have descended most of the sorgos now grown in the United States.

With these two importations was inaugurated a long series of thorough and expensive experiments in making sugar and alcohol from sorghum, which continued without interruption for thirty years. During the progress of similar work in America, large quantities of the seed of our leading saccharine varieties were sent from here to Spain and other parts of southern Europe. Neither these nor Mr. Wray's original importations seem to have persisted there in cultivation as pure varieties.

At the present time few varieties are to be found in Europe, and these are usually very badly mixed. A rather large, somewhat saccharine variety, with spikelets much as in Gooseneck sorgho, but with a compact, obovate, erect, black head, is found in Germany, France, and Austria. It is quite different from



FIG. 14.—Head of *Holcus niger*, after Arduino, 1786.

any variety now grown in the United States and is probably a remnant of the importation from Natal. Some Amber and Orange sorghum can still be found in France and Spain. It is probable that the blood of a number of the different saccharine varieties is mingled in the variable and often worthless hybrids now found in southern Europe.

A white durra is found in occasional cultivation in Europe. It is the form prevalent in northern Africa rather than that of Arabia and Syria, and has come largely from Algeria by way of France (fig. 6, c).

SOUTH AMERICA.

No sorghum varieties are indigenous to the New World. *Andropogon halepensis* itself is an introduction, though now found abundantly in tropical and subtropical America. In South America broom corn is quite widely but not extensively grown. Amber sorghum from the United States is sparingly introduced. No other varieties are found, except occasionally under trial at experiment stations.

WEST INDIES AND CENTRAL AMERICA.

Throughout the West Indies and sparingly on the east coast of Central America a variety is found quite similar to blackhull kafir in the characters of the head. In its vigorous stooling and abundant leaves it still more closely resembles other Afri-

can varieties. It was introduced long ago from the Guinea coast of Africa with the slaves, whose food it had been in their native home. Sloane records it as widely cultivated in Jamaica in 1707. In the English islands it was, and still is, known as "Guinea corn," in the French islands as "petit millet," and in Honduras as "maysillo" (probably "little corn"). It is quite generally cultivated for human food for

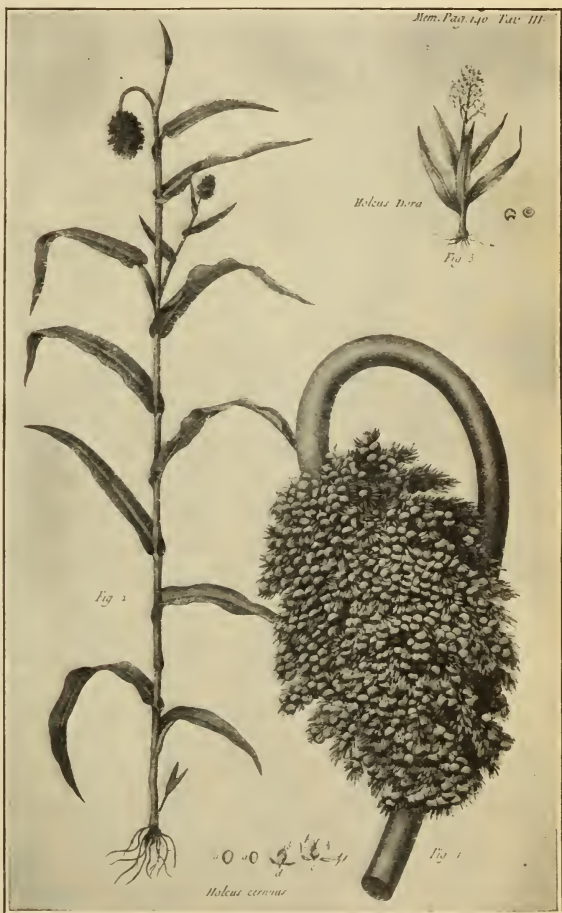


FIG. 15.—Plant and head of *Holcus cernuus*, after Arduino, 1786.

the laboring classes, and also as forage for stock. The small seeds are white or pearly white in color and the short glumes are usually black. It is probably the progenitor of the form occasionally found in the United States under the name "white millo maize," and for which the author has suggested the name Guinea kafir. It has no value in this country, unless perhaps for silage in the extreme South.

UNITED STATES.

The early history of sorghum varieties in the United States is quite obscure. It is known that the growing of broom corn for domestic use became a considerable industry in colonial times. It is certain also that some grain varieties were introduced and sparingly grown in the early days of the colonies. From time to time a variety, though not always the same one, was exploited, under the name of "chocolate corn," as a substitute for tea and coffee. However, aside from broom corn, no sorghum had become a permanent crop before the middle of the last century.

Accounts vary somewhat as to the date and manner of the first introduction of the Chinese sorgo (fig. 9) from France. Apparently it was first grown by William R. Prince,^a a nurseryman, of Flushing, Long Island, New York, in 1853, and sold by him to a few other persons for testing in 1854. A hogshead of seed was sold by him in 1855. The United States Commissioner of Patents^b secured a small quantity of the seed in France in 1854 and grew it in 1855, continuing the experiment through the succeeding year. In that year, 1856, a 75-foot row was grown by the editor of the *American Agriculturist*^c from seed secured from the firm of Vilmorin-Andrieux & Co., of France. In the spring of 1857 the *American Agriculturist* distributed over 1,600 pounds of the seed to 31,000 of its subscribers. Most of the seed was imported direct from France, though a small quantity was secured from growers in the vicinity of New York, N. Y. In the same year the United States Patent Office distributed 175 bushels of home-grown seed and 100 bushels of imported seed. In the spring of 1858 the *American Agriculturist* distributed, in 1-pound packages, 34,500 pounds of seed grown in Georgia from its imported seed of the year before. It is not probable that extensive distributions were made after this date. The supply already sent out was sufficient to scatter the variety very extensively over the entire country. The widespread and increasing interest in this crop was

^a Report, U. S. Dept. of Agriculture, 1877, p. 233.

^b Reports, U. S. Patent Office, 1854, pp. xxii and 219-223; 1855, p. xii and 279-280; 1856, p. 5. Report, Iowa State Agricultural Society, 1861, p. 207.

^c *American Agriculturist*, vol. 20, 1861, p. 6; vol. 39, March, 1880, p. 116; vol. 40, March, 1881, p. 94.

not because of its forage, or even its sirup value, but as a probable source of sugar. It was then known as sorgho in Europe and America.

In May, 1857,^a the sixteen saccharine varieties obtained by Mr. Leonard Wray in Natal in 1851 were brought by him from Europe to the United States at the request of Hon. Horace Greeley. They were not distributed to the public, but were first sown in South Carolina and Georgia under Mr. Wray's immediate supervision. He had taken out United States patents on his method of making sirup and sugar, and is said to have purposed controlling the income from the use of his varieties. These African varieties were known collectively as "imphée," each variety having in addition a native Zulu name. The names of the varieties, as published by Olcott (1857), were as follows: Vimbischuapa, Eanamoodée, E-engha, Neeazana, Boomvwana, Comseeana, Shlagoova, Shlagoondee, and Zimmoomana, with brief descriptions, and Ebothla, Booeana, Koombana, See-engla, Zimbazana, and Ethlosa, mentioned by name only. In the pronunciation of these names each vowel, except where doubled, is the basis of a syllable. Though only fifteen names appear, Mr. Wray states that sixteen varieties were obtained by him in Natal. Many years later Wray^b identified plate 5 in Special Report No. 33 of the Department of Agriculture and in the report of this Department for 1880 as his "Enyama," which is not given in the list above, but was doubtless the sixteenth variety. A variety was on sale in the city of New York under this name in the spring of 1859.

Between the years 1860 and 1880 agents were sent to China^c to discover and bring back other varieties, and considerable importations were made also from South Africa and India.^c No other saccharine varieties were found in China, though several ordinary kowliangs were obtained. The importations from Africa, though coming under names very different from those of Mr. Wray's forms, apparently did not represent any new varieties. The Indian varieties were either nonsaccharine or so slightly saccharine as to be valueless for sirup or sugar production. They were mostly too late to be of much value for forage and grain.

All these varieties were soon as widely distributed over the country as their particular climatic adaptations would permit. Hybridization, variation, and selection, combined with the desire of growers to

^a Hedges, I. A. Rural New Yorker, vol. 40, May 7, 1881, p. 1. American Agriculturist, vol. 16, 1857, pp. 142, 276-277.

^b See Collier, 1884, p. 68.

^c Sorgo Journal, vol. 7, October, 1869, p. 91; Collier, 1884, loc. cit., pp. 76-82; American Agriculturist, vol. 45, April, 1886, pp. 153-154; Bulletin 20, Bureau of Chemistry, U. S. Dept. of Agriculture, 1889, p. 112, 119.

find a market for their seed, resulted in the speedy multiplication of the so-called "varieties" to an enormous extent. Two hundred or more names are recorded for saccharine varieties alone. It is doubtful if the number of actual varieties concerned was ever more than twenty. Not more than a dozen are now in cultivation in this country. Of these, Amber and its forms are said to be directly derived from the original Chinese sorgo, though it has not been proved that some of these forms were not secured in Africa. All others are presumably descended from the Natal varieties. The definite varietal origin of some is known, as Orange and perhaps Planter from Neeazana, and Sumac from Koombana; others, as Collier, Planter, Sapling, Gooseneck, Honey, etc., can not be certainly connected with a particular one of the poorly described African varieties, but are most surely original sorts from that source.

The sorgos, or saccharine sorghums, are now grown to a very limited extent for sirup production and to quite a large extent for forage. The total area grown in the United States is probably about one and one-half millions of acres annually. A large part of this is in the southern half of the Great Plains area. During the recent unusually wet seasons there has been a perceptible decrease in the acreage in that region, owing to the opportunity for better crops of corn and cereals. The Amber, Orange, and Sumac varieties make up the bulk of the crop.

Kafir and durra are of quite recent introduction and distribution in the United States. Varieties of the kafir group first reached this country in 1876, but were not generally distributed until ten years or more later. The original variety, white kafir, has almost completely disappeared from cultivation. Its place has been taken by the more recent blackhull kafir, which makes up probably nine-tenths of the total kafir crop, red kafir furnishing the remaining tenth. White durra and probably other durras have been introduced many times since colonial days, but without permanent results until 1874, when our white durra and brown durra were brought into California. The total area of these two crops probably does not exceed 50,000 to 60,000 acres annually. Milo appeared about 1885 under circumstances not yet ascertained. The annual acreage is probably about 300,000 acres. The total area devoted to kafirs and durras combined is probably not far from another one and one-half millions of acres. This would make a grand total of three million acres of sorghums annually grown in the United States.^a Their annual value may be conservatively estimated at \$30,000,000.

^a These estimates were made in June, 1908.

CANADA.

The earliest maturing varieties of sorgho from the United States, chiefly Amber and its forms, have been grown in Lower Canada for some years as hay and fodder crops.

BOTANICAL HISTORY AND NOMENCLATURE OF SORGHUM.

PRE-LINNEAN PERIOD, FIRST CENTURY TO THE YEAR 1753.

During the early part of the pre-Linnean period sorghum was introduced into Europe and became widely cultivated under many popular names. With the revival of learning in the latter part of the period it received abundant attention in agricultural and medicobotanical literature and acquired a considerable polynomial nomenclature.

According to Pliny, as has been stated, sorghum was introduced into Italy from India during the first century. In his writings he includes it under the general term "miliun," or millet, used then, as now, to designate the cultivated forms of several different species of grain-producing grasses. The most important of these were the grasses now known as *Panicum miliaceum* (proso millet) and *Chaetochloa* (*Setaria*) *italica* (foxtail millet). Pearl millet (*Pennisetum spicatum*) and even corn (*Zea mays*) were included under the name miliun by various ancient authors.

Even from the very brief description given by Pliny we may be sure that he was writing of some sorghum. "Miliun intra hos decem annos ex India in Italiam invectum est. nigrum colore, amplum grano, harundineum culmo, adolescit ad pedes altitudine septem prægrandibus culmis: lobas vocant: omnium frugum fertilissimum. Ex uno grano terni sextarii gignuntur. Seri debet in humidis. Frumenta quædam in tertio geniculo spicam incipiunt concipere, quædam in quarto, sed etiam num occultam." The very stout, reed-like culms, 7 feet tall, exclude all other millets except pearl millet. The abundant grain and black color separate it from that species, while all these characters agree readily with those of sorghum.

ORIGIN OF POPULAR NAMES.

The name miliun is derived from miliarius, or milliarius, which means "containing a thousand," and has reference to the large number of seeds in each head. From it our words millet, millo, and milo have been derived. For many centuries sorghum in general was known as miliun, or miliun indicum, literally Indian millet, and this latter name was still in use fifty years ago. Just how early other names came into use for sorghum can never be known, owing to the lack of literature on such subjects during mediæval times. It is natural that such names should have originated soon after the intro-

duction of this crop and should have increased in number as the plant became more widely distributed among tribes and nations.

By the beginning of the sixteenth century sorghum was to be found throughout Italy, Spain, France, Belgium, and Germany under a great variety of names. A very large number of these names were used in different parts of Italy. Melica, melega, and milica were derived from either "mel" or "mellis" (honey), or more probably from "melligo" (a honey-like juice). Sagina, or saggina, was derived from the Latin "sagino," to fatten. Sorghi, sorgi, sorgho, sorgo, sorghum, and surga are derivatives from the Latin "surgo," to rise or tower, in reference to its towering high above all other crops. In Germany there was applied to it the distinctive name "Welschenhirse," i. e., foreign, or, more particularly, Italian millet, and also "Sorgsamen." In Belgium the name "sorgsaet" was given it. The derivation of these last names from the Italian "sorgho" is obvious. It was known also as *Milium indicum*, *M. insubrum*, *M. sabaeum*, and *M. saracenicum*, as the seed was thought by the various writers to be of Indian, North Italian, Arabian, or Saracenian origin, respectively.

Throughout the past century all writers on sorghum in cyclopedias and agricultural and botanical works have reiterated that the name sorghum, or sorghi, is the common name of this plant in the Orient. There is not the slightest evidence in support of the theory; on the contrary, as early as 1592 Porta had pointed out its origin from the Latin "surgo."

EARLY AUTHORS AND EARLY NAMES.

It is impossible to take up in detail the statements made by the many medical and agricultural writers of the sixteenth century and earlier. The latter repeated the facts and also the errors of the earlier authors, with additional notes of their own. The following is a chronological list of the more important pre-Linnean authors, showing the names under which they discuss sorghum. In most cases they also cite other names by which sorghum was known among the different nations of their time:

- Pliny, first century, "*Milium ex India*."
- Ruel, 1537, "*Mellica*."
- Crescenzi, 1542, "*Saggina*," "*Melica*."
- Fuchs, 1542, "*Sorgho*."
- Tragus (Bock), 1552, "*Panicum*."
- Scaliger, 1556, "*Sorghum*."
- L'Obel, 1576, "*Sorgho*," "*Melica Italarum*."
- Dodoens, 1583, "*Melica*" or "*sorghum*."
- Cæsalpini, 1583, "*Melica*," "*Sagina*."
- Porta, 1592, "*Sagina*," "*Melica*," or "*Surgo*."
- Mattioli, 1598, "*Milium Indicum*."
- Belon, 1605, "*Sorghum Insubrum*."

- Besler, 1613. "*Milium Plinii*;" "*Sorghum fructo rubro*;" "*Sorghum fructo albo*."
- Bauhin, C. 1623, "*Milium Sabaeum*;" "*Milium arundinaceum subrotundo semine. Sorgo nominatum*;" "*Milium arundinaceum plano alboque semine*."
- Parkinson, 1640, "*Melica, sive sorghum*."
- Bauhin, C., 1658. "*Milium arundinaceum sive Indicum semine subrotundo*;" "*Milium arundinaceum semine plano et albo*."
- Hermann, 1657. "*Milium indicum, arundinaceo cauli, granis flavescentibus*;" "*Milium indicum, arundinaceo cauli, granis nigris*;" "*Milium arundinaceum subrotundo semine; Sorgo nominatum*;" "*Milium arundinaceum plano alboque semine*."
- Ray, 1688, "*Sorghum*" or "*Milium Indicum*;" "*Milium arundinaceum semine subrotundo*;" "*Milium arundinaceum semine plano et albo*."
- Breyne, 1689. "*Milium Indicum sacchariferum altissimum semine rotundo atro*;" "*Milium Indicum sacchariferum altissimum semine ferrugineo*."
- Sloane, 1696, "*Milium Indicum*."
- Morison, 1699. "*Milium majus Sabaeum*;" "*Milium majus arundinaceum subrotundo semine*;" "*Milium majus arundinaceum plano alboque*."
- Tournefort, 1700, "*Milium arundinaceum*."
- Sloane, 1707, "*Milium Indicum*."
- Micheli, 1729, "*Sorghum*" (nomen nudum).
- Linné, 1737, "*Holcus glumis glabris*;" "*Holcus glumis villosis*."

Just what variety of sorghum was introduced into Italy in Pliny's time we have no means of knowing. There is at least a strong probability, however, that it was a sweet variety. Pliny describes the seed or head as of a black color, apparently not distinguishing between the seeds and the black glumes which inclosed them. In recent times most black-glumed forms with seeds wholly inclosed have been saccharine varieties. At any rate, a sweet variety must have been introduced at an early date, because we find such names as *melica* and *melega*, referring to sweetness, in use as early as any names more distinctive than *milium* or *panicum*. Between the first and sixteenth centuries there is naturally not a very extensive literature on the subject. Avicenna, who lived in the tenth century, writes of a form used by the Arabs and called "*hareoman*" (said to be a misprint for *hartoman*). Crescenzi (1542) is said to have written about 1300 A. D., and later editions of his work refer to the plant in Italy as *sagina*, or *melica*. The writer has been able to consult no edition earlier than the one cited.

SIXTEENTH CENTURY WRITERS.

During the sixteenth century many able writers describe the plant and its uses; some give good illustrations. None of them recognizes more than a single variety.

Fuchs (1542) and Tragus (1552) figure similar plants with heavy and compact but erect heads (fig. 10). This sorghum is much like the Orange sorgo in general appearance and is apparently the variety afterwards named *Holcus sorghum* by Linné. It is certainly the

plant so recognized by Arduino (1786). L'Obel (1576) figures a variety with more open panicles, like the early illustrations of the Chinese sweet sorghum. Dodoens (1583) and Parkinson (1640) use the same figure (fig. 11). Mattioli (1598) shows a different form (fig. 16), somewhat intermediate in head characters between the other two.

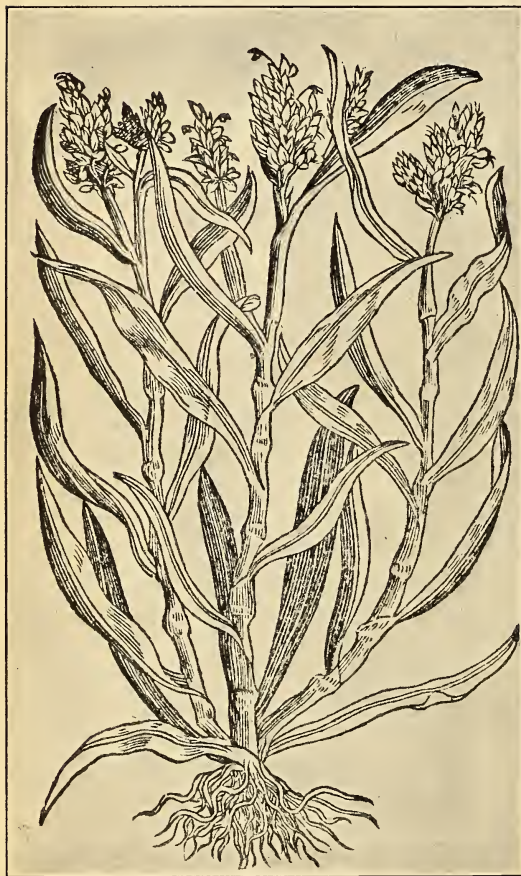


FIG. 16.—Plant of sorghum, after Mattioli, 1598.

A. D., “*Quique bibunt tenera dulces ab arundine succos*,” may be construed as referring to sorghum. Except in describing the stalks as tender, this description applies equally well to sugar cane, and it may be only a bit of poetic license.

Those who describe the plant speak of the seeds as red or reddish. Some authors mention forms with seeds of various colors, from white to black. Cæsalpini (1583) states, however, that only the form with purple spikelets is the plant commonly called *sagina*, or *melica*, the others being the smaller millets.

Tragus (1552) speaks of the sweet fodder produced by sorghum. Many other writers speak of the sweet seed, but the word sweet, as used by them, seems to refer to the absence of an astringent or bitter quality rather than to the presence of any saccharine character, which would of course not appear in the seeds. None of these writers makes direct reference to a sweet juice contained in the stems or to the use of the plant as a source of saccharine matter, unless indeed the following much-quoted words of the poet Lucian, who wrote presumably in the second century

The writers of the seventeenth century began to separate the plant into varieties or races, based chiefly on the color of the seeds. Bauhin (1623), under the general heading "*Milium Eiusque Species*," names, with copious synonymy and brief description, five different kinds, the first two of which, "*Milium semine luteo vel albo*" and "*Milium semine nigro*," are probably not sorghums. The last three, however, "*Milium sabæum*," "*Milium arundinaceum subrotundo semine*," "*Sorgo nominatum*," and "*Milium arundinaceum plano alboque semine*," "*Sorgo simile granum*," *Hareomen Arabum*, Bellonio," are almost certainly different varieties of sorghum. The first of these three is not described, but as the name is derived from Saba, the capital city of Sabæa, in Arabia, the plant may have been the same as the third form. The second is the form which was then commonly grown in southern Europe and which had been described and figured by many earlier writers. The third, from the description and synonymy, is clearly the white-seeded durra of Arabia mentioned by Avicenna, Rauwolf, and others. Two distinct varieties are here discussed, the common European form with reddish seeds and an Arabian variety with white seeds, the latter probably a form of white durra.

Parkinson (1640) describes sorghum under the title "*Melica sive sorghum*, Indian Millet." He uses the same figure as several other authors, namely, that of L'Obel. Evidently only one variety is in his thought and that one the common and long-cultivated form. Of the white, flat-seeded variety he makes no mention.

Caspar Bauhin (1658) gives full descriptions of the two sorghums he had merely listed under *Milium arundinaceum* in his "*Pinax*" (1623). These were the common sorghum of Europe and the white-seeded sorghum of Arabia. The common form he describes as producing from one seed 4 to 5, or more, stout and somewhat sweet culms, with leaves $1\frac{1}{2}$ feet long and 3 to 4 inches wide, and erect heads 9 inches long and 4 to 5 inches in width, containing abundant seeds, mostly reddish or deep red, occasionally pale or yellowish in color. This sorghum had been introduced from India into Spain, Italy, and elsewhere. Bauhin thus holds the sorghum of Europe to be but a single variety or species, the *milium indicum* of Pliny. His figure is that of Mattioli, sixty years before. The white-seeded form of Arabia, Mesopotamia, and Asia Minor he notes as having a culm similar to corn or sugar cane, 9 to 12 feet high, filled with sweet pith, from which the natives extract, by chewing, a sweet juice, and bearing a beautiful white panicle 6 inches long, containing hard and brilliantly white, flattened seeds. From the white durra now grown extensively in the same region this form apparently differs in two important respects—the sweet juice and the erect heads. Bauhin

does not state that the heads are erect, but so striking and unusual a character as pendent heads would certainly have received mention if known to him. It is, however, quite possible that this fact had not become known in Europe, since the plant was cultivated no nearer than Cilicia in Asia Minor. If it is, indeed, the progenitor of the white durra now occupying the same region, the saccharine quality of the juice has been entirely lost.

Hermann (1687) presents the different forms of sorghum in the following manner:

Milium indicum, arundinaceo cauli, granis flavescentibus.

Milium indicum, arundinaceo cauli, granis nigris.

Milium arundinaceum, subrotundo semine, *Sorgo nominatum*.

Milium arundinaceum, plano alboque semine.

The first two he evidently thought to be new and so described them. The last two are simply quoted on the authority of Bauhin, without description. Hermann seems to think his second variety to be the Indian sorghum of Pliny. He describes it as having black seeds, but does not mention the glumes, while in the first form he speaks of the seeds as pale and the glumes as black and brilliant. Since there are no sorghums with black seeds (*grana nigra lucida*) it is probable that his two varieties were the same thing, described from hearsay rather than observation. In the first variety the color of the actual seed is given; in the other, the color of the spikelet.

Ray (1688) cites the two varieties of C. Bauhin, omitting *Milium sabaeum*, and copies most of Bauhin's notes on them.

Breyne (1689) discusses sorghum as "*Milium Indicum sacchariferum altissimum*," and describes two forms having "*semine rotundo atro*" and "*semine ferrugineo*," respectively. He is the first author to recognize the saccharine content of the plant in forming a name for it. This work is not accessible, and it is not known what varieties Breyne had in hand.

Sloane, in his "*Catalogus*" (1696), gives a copious bibliography and synonymy of this plant, including all previous authors.

Morison (1699) places under the generic heading *Milium* two sub-groups: *Minus*, including wild and cultivated species of *Panicum*, and *majus*, including sorghums and probably pearl millet. Of sorghums there are three, the names being quoted from C. Bauhin and identical with those used by him in his "*Pinax*" (1623). Concerning the white-seeded variety he gives the new and important information that the head is pendent, but has no illustration of it. In his description of *Milium sabaeum* no mention is made of a pendent head, but his figure shows a group of two stalks, one bearing an erect head and the other a pendent head. Both varieties were Arabian, and it is quite possible that they were the same. He is the first author who definitely records a sorghum with a pendent head.

EIGHTEENTH CENTURY WRITERS.

Sloane (1707) gives a description of the Guinea corn of Jamaica. In this connection he supplements the synonymy given in his earlier "Catalogus" by citations from subsequent authors. He states that this form of sorghum was then in very general culture on that island, as it probably was in others of the West Indies. From the brief description, the plant seems to be identical with the variety peculiar to and extensively grown in many of the West Indian islands at the present day under the same name, Guinea corn. It is almost certain that this plant was brought from the west or Guinea coast of Africa with some of the slaves, whose chief food-grain it had been in their African home. It is discussed in this bulletin under the name Guinea kafir (fig. 3, *b*) in the paragraph on the West Indies.

Micheli (1729) proposed the generic name *Sorgum* for these plants as segregates from the genus *Milium* of Tournefort. He did not, however, describe any species in this connection, nor did he indicate what plants of Tournefort should be included in his genus. The name stands, therefore, as a nomen nudum. Tournefort in 1700 had simply lumped sorghum with *Panicum miliaceum* as milium, and cited under it all the names given by the two Bauhins with some new ones of his own, which are, however, not worthy of further attention.

Linné (1737) transferred these plants to his recently erected genus *Holcus*. The common form is treated as *Holcus glumis glabris* and the white-seeded, or durra, variety from Arabia as *Holcus glumis villosis*. For our purposes this work terminates what is called the pre-Linnean period, the next botanical contribution of any great importance being Linné's "Species Plantarum," wherein began in 1753 the general application of a binomial system of nomenclature for plants.

LINNEAN PERIOD, 1753 TO 1850.

Throughout the Linnean period botanists treated the diverse forms of this cultivated plant as botanical species. Nearly thirty species were named and about sixty binomial combinations made.

THE SPECIES OF LINNÉ AND FORSKÅL.

Linné (1753) published two species of sorghum under his exceedingly composite genus *Holcus*, namely, *Holcus sorghum* and *H. saccharatus*, adding thereto the wild species as *H. halepensis*. The cultivated species were both from India. Under *Holcus sorghum*, described as "glumis villosis seminibus aristatis," he evidently placed the common European sorghum of earlier authors, since he makes his *Holcus glumis glabris* of 1737 a synonym. The Arabian form with flat white seeds is not mentioned at all, either by name or in the synonymy, though by inference it is included in this species. *Holcus*

saccharatus is described as "glumis glabris seminibus muticis," based on the *Milium indicum granis flavescentibus* of Hermann and the *Milium indicum sacchariferum altissimum seminibus ferrugineo* of Breyne. In the second edition, 1763, it is described as having an erect, subverticillate panicle with wide-spreading or somewhat drooping branches, in contrast with the small, erect, and ovate heads of *Holcus sorghum*. Both species are credited with villous glumes and awned lemmas (flowering glumes), and are distinguished by the size and character of the panicle.

In his "Mantissa" (1771) he restricts the name *Holcus sorghum* to a strain of the ovate-panicled form with green villous glumes, and adds Bauhin's form with flat white seeds as a synonym. He then permits the open-panicled *Holcus saccharatus* to have hairy glumes and awned lemmas also, and describes a new species, *Holcus bicolor*, similar to *H. sorghum*, with glabrous black glumes and globose-white seeds, in awned lemmas, transferring his *Holcus glumis glabris* of 1737 to *Holcus bicolor* as a synonym. This new species was said to have come from Persia, which probably indicates that it was an Indian variety perhaps secured through Persia. A similar form is found abundantly in India to-day. It could scarcely have been the white durra of Arabia, etc., because that had pale glumes.

Forskål (1775) added two species from Egypt: *Holcus dochna* and *H. durra*, the specific names being derived from the common names of the varieties in that country. *Holcus dochna* was probably a saccharine or semisaccharine sort, but is not now certainly identifiable. Both Koernicke (1885, p. 310) and Hackel (1889, p. 509) place it as a synonym under *saccharatus*. Forskål does not mention it as saccharine, but the description accords well with that of the sweet forms. His *Holcus durra* included at least two of the three durra varieties common in Egypt to-day, namely, the white seeded (beda) and the brown seeded (ahmar). Indeed, Forskål makes it cover two white-seeded forms, one with greenish glumes and one with brownish glumes. Koernicke (1885, p. 312) places the reddish-brown-seeded sort under the variety *arduini* Gmel. In 1887 he proposed the name *egyptiacus* for the white-seeded form. Hackel follows him in this, placing under his variety *durra* only a yellow-seeded (safra) form; he does not seem to have had the brown-seeded form at all. These three forms, beda, safra, and ahmar, with white, yellow, and brown seeds, respectively, are in common cultivation in Egypt to-day. They are practically identical except for the color of the seed, and really represent but a single botanical variety instead of three.

THE SPECIES OF ARDUINO.

Arduino (1786) published descriptions of six species of sorghum, three of which he considered new, the other three being those de-

scribed by Linné. All the species are excellently illustrated on folio plates, and the descriptions are more exact and complete than those of any previous author. Arduino's paper had been presented in 1780 and his experiments had been in progress since 1775, and perhaps for a longer period. He was probably the first author to grow and carefully study in the field all the forms he could obtain. His three new species are *Holcus cafer*, *H. cernuus*, and *H. niger*.

His *Holcus cafer* is the most interesting of all, because it was a recent arrival in Italy from "Cafreria" (Natal), in South Africa, which Arduino describes as "an exceedingly vast province of Africa." How it was obtained is not stated. The description and figure show a form with an umbellate panicle, the long, heavily seeded branches drooping in the form of an umbrella (fig. 13). In appearance it is identical with the drooping strain of Planter sorgho now grown in this country, and which is of known Natal origin. We thus have our Planter sorgho antedated by seventy-five years. Arduino's variety was described as 8 feet or more in height, with stalks as large as American corn, 12 or 13 leaves, and an umbrella-like panicle with drooping branches 6 inches long. The heavy stalks, filled with sweet juice, weighed three or four times as much as those of the ordinary forms, and the stems and foliage remained green until frost, even when the heads were harvested. The reddish seeds were considerably exserted from the small hairy glumes. It is the *Sorghum arduini* of Jacquin (Eclog. Gram., pl. 18, 1791); the variety *cafer* of Koernicke (1885, vol. 1, p. 307); and is doubtfully admitted by Hackel (1889, p. 519).

Arduino believed his *Holcus niger* to be the black sorghum of Pliny and Tournefort. He illustrates (fig. 14) a loose, ovate-pyramidal panicle not nearly so lax and spreading as that of *Holcus saccharatus*. It is much like some of our more compacted Amber forms and the Oomseeana of Wray.

Arduino's *Holcus cernuus* (fig. 15) is our white durra, based on the white-seeded variety of Arabia, etc., discussed by so many of the older authors. Arduino is naturally puzzled by the action of Linné in uniting this form with his *Holcus sorghum*, as he did in his "Mantissa" (1771).

In Arduino's interpretation of Linné's *Holcus sorghum* (fig. 12), it is described as from 6 to 8 feet in height and an inch in diameter, with 8 to 10 leaves and an erect, oval, compact panicle full of seeds of various shades of red and yellow, some included and some partly exserted, the lemmas being awned or awnless. Linné's *Holcus saccharatus* (fig. 12) Arduino describes as a tall, slender cane with long, slender leaves and a sparse, lax panicle about a foot long, with drooping branches, awned or awnless spikelets, smooth or hairy glumes, and

seed varying from pale yellow to deep red. He states that these three species, *Holcus sorghum*, *H. niger*, and *H. saccharatus*, had long been cultivated in Italy and were very variable. He calls them light yielders of seed. From *Holcus sorghum* floor brooms were made, and from *Holcus saccharatus* all kinds, from whisk brooms to scrubbing brushes. He calls especial attention to the variability of the species *Holcus sorghum* and *H. saccharatus*. While it is likely that other importations than that recorded by Pliny were represented in the forms described by Arduino, it is certain that many of these forms must have arisen through variations and crossing which took place in Europe. For many years thereafter these varying forms were made the basis of new species by the botanists of that period.

NUMEROUS SPECIES OF LATER AUTHORS.

Koeler (1802) founded his genus *Blumenbachia* on the wild *Holcus halepensis*, but the name was never taken up for the cultivated plant. Brotero (1804) transferred *Holcus sorghum* and *H. halepensis* to the genus *Andropogon*. Persoon (1805) took up the old generic name *Sorghum*, first proposed by Micheli, and rechristened the cultivated plant *Sorghum vulgare*. During the first half of the nineteenth century many more cultivated forms were described as new species, until the total number of species was thirty or more. The following is an alphabetical list of the names used for cultivated sorghums described as species: *Albus*, *arduini*, *besseri*, *bicolor*, *cafer*, *caffrorum*, *campanum*, *cernuum*, *commune*, *compactus*, *dochna*, *dora*, *drummondii*, *duna*, *durra*, *dulcis*, *ferrugineus*, *nervosum*, *nigricans*, *niger*, *nigerrimus*, *pyramidale*, *rubens*, *saccharatus*, *sorghum*, *subglabrescens*, *truchmenorum*, *usorum*, *versicolor*, and *vulgare*. Some of these names have been used in all three genera, *Holcus*, *Sorghum*, and *Andropogon*; some have been used in two; others only in one. In this manner a total of fifty-five or sixty binomial combinations has been reached.

Most of these so-called species are quite unimportant. A few of them probably include forms which have since become extensively cultivated in this country. It is almost impossible to identify these species from their meager descriptions, especially those described from regions where sorghums are abundant and variable. In consulting the writings of different authors who discuss a form under the same specific name, it becomes evident that they did not always have the same plant in hand. For example, the name *bicolor* of Linné has at one time or another been applied to almost every form with white seeds and dark glumes. In the same way the name *cernuus* of Arduino has been used for all forms with pendent panicles, without much regard to other characters involved.

RECENT PERIOD, 1850 TO THE PRESENT TIME.

By the middle of the last century the conception of cultivated forms of sorghum as species had been abandoned and the description of them as horticultural and botanical varieties was begun. Olcott (1857) published Leonard Wray's brief descriptions of his recently introduced Natal varieties (fig. 17). Stewart (1867) reprinted these descriptions, but neither attempted any classification.

BEGINNINGS OF CLASSIFICATION.

Pech (1865) published a provisional classification of the few sweet varieties then known to him. Collier (1884) amplified Pech's out-

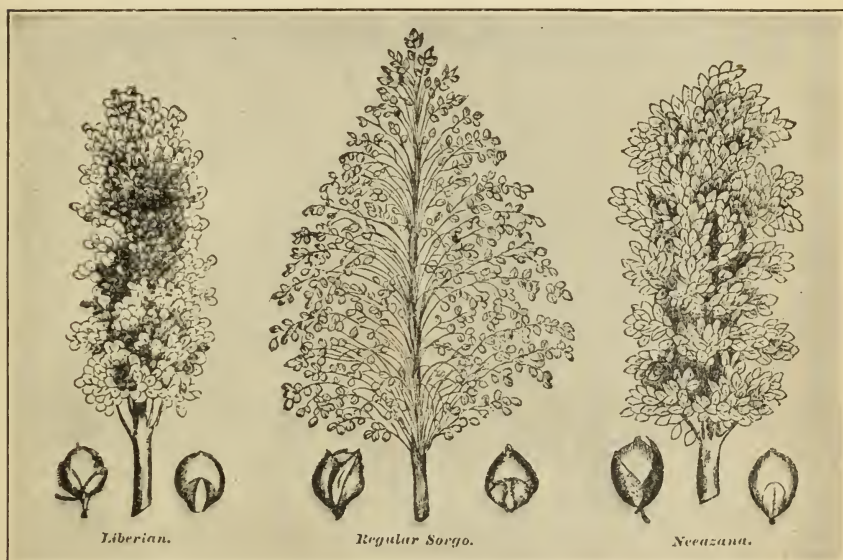


FIG. 17.—Heads of three sorghum varieties figured in 1869. "Liberian" is Wray's Koombana, the present Sumac; "Regular sorgo" is the Chinese variety; and "Neeazana" is the original form of Orange.

line by inserting a number of recently developed saccharine varieties, many of which were local strains that never became generally grown and are not now identifiable. These two classifications were made on a natural basis, and if fuller and more definite would be fairly usable, though wrought out from confessedly imperfect material and insufficient field study and including only a limited number of forms, of which all except one were sorgos.

Koernicke (1885) presented the first attempted classification of the cultivated forms of the whole world. He recognizes them as comprising a single species *Andropogon sorghum* (L.) Brot., and disposes them in twelve varieties, grouped into two sections, Effusus and Contractus, referring to the habit of the panicle.

The first section includes five varieties: *Cafer* Ard., *technicus* Kcke., *saccharatus* L., *leucospermus* Kcke., and *niger* Ard. The first two varieties are separated from the others by having a much shortened rhachis, or central axis, in the panicle. The variety *cafer* is our Planter sorgo, or a very similar variety, while the variety *technicus* is broom corn. The last three are apparently all sorgos or sweet sorghums. The variety *saccharatus* is much like our most spreading Red Amber, the variety *leucospermus* is not determinable, and the variety *niger* is probably identical with some of our smaller and more compact Amber forms, as Black Dwarf. Koernicke's *leucospermus* had not white seeds, but red, the inappropriate name apparently referring to the pale glumes, due perhaps to the acknowledged late and incomplete maturity of the specimens on which it was based.

The second section contains seven varieties, of which the first four—*usorum* Nees., *arduini* Gmel., *aethiops* Kcke., and *bicolor* L.—had erect heads, and the last three—*cernuus* Ard., *truchmenorum* Koch., and *neesii* Kcke.—had the heads pendent. Of the first group, with erect panicles, the variety *usorum*, with short compact heads, is not certainly identifiable with any of the hundred or more Natal forms studied by the writer. Variety *arduini* is probably our Orange sorgo, variety *aethiops* is not known, though it is perhaps the sorgo form with ovate black heads still grown in central Europe. Variety *bicolor* is not identifiable among the many similar forms of India and equatorial Africa. Considering, now, the three varieties having pendent heads, it is known that the variety *cernuus* includes, among others, our white durra, and that the variety *truchmenorum* is that form of white durra with taller stalks and more compact heads found in Turkestan, where it is called, in Russian, "Dzhugara." Variety *neesii* is a blackhulled white durra from the region of Natal. It has never been found in the recent importations from there.

Hackel (1889) divides *Andropogon sorghum* into two subspecies, *halepensis* and *sativus*, thus including both the wild and the cultivated forms in a single species. His subspecies *sativus* is the *Andropogon sorghum* of Koernicke's classification and the *Sorghum vulgare* of Persoon. He divides this subspecies into nine sections, which contain a total of thirty-six varieties. These nine sections, or groups, are separated largely on such characters as the comparative shape and size of the spikelets, the comparative length and width of the glumes, and the relation of these to the seed. The density of the panicle, the position of its branches, the color of the seeds, and the presence and length of the awn are used as minor determining characters. No mention is made of the size and height of the culms, the character of the juice, the number or size of the leaves, the comparative length of the sheaths and internodes, or of the purpose for which the varieties are grown.

In Africa there naturally has been but little done toward a study of the numberless forms of sorghum. In Egypt the British agricultural officials have studied quite carefully the native varieties, and the writer is much indebted to them for various shipments of seed and for provisional classifications, which are apparently very accurate. Colonial officers in French West Africa ^a (Niger Valley and Senegal) and in German East Africa ^a have published brief notes on the leading varieties of their regions. Schumann (1895), Busse and Pilger (1902), and Pilger (1904) have described botanically a very large number of forms from German East Africa and from Togo on the Guinea coast. Their descriptions are apparently based on dried material, mostly heads. Without the cultivation and field study of varieties for at least two or three seasons, such descriptions are of little value to the agronomist.

In India a comprehensive effort to assort, classify, and describe the manifold forms of that extensive region is now being made. Hooker (1897) gives a synopsis of the varieties of India as outlined by Hackel and also by Stapf. The Reporter on Economic Products for India, Mr. I. H. Burkill, has been engaged for several years in this work. A synopsis of a portion of his outline of classification was published by Benson and Subba Rao (1906) with valuable additions of their own. For the varieties of the Madras Presidency, occupying the southern portion of the peninsula, these last-named gentlemen have made a provisional classification, which has the decided merit of taking into account the agronomic characters of the plants.

In recent years the number of trinomials and other polynomials applied to sorghum varieties has been increased to literally hundreds. It is an open question whether any useful purpose is subserved by the wholesale application of Latin trinomials to the exotic cultivated forms of a variable plant like sorghum, especially where the study is limited to immature or fragmentary dried material. Where a field study of the growing plants is also made, the final number of varieties is always greatly reduced and the practice becomes less objectionable.

A satisfactory classification of the varieties of sorghum or of any other cultivated plant must take account of the habit and characters of the entire plant, not merely of the panicles. The height, size, and color of the stalks, the comparative length of the internodes and sheaths, the number, size, and color of the leaves, the length, stoutness, and exertion of the peduncle, and the number of branches and suckers are all of vital importance in the study of varieties. Comparative earliness, disease resistance, drought resistance, and pro-

^a Dumas, 1905, and Lambrecht, 1903.

ductiveness, with other available ecologic characters, ought to be included.

Furthermore, the use of purely artificial keys must be given up and natural groupings substituted before much permanent good can come from any classification of cultivated varieties. The lumping of all the forms which happen to have white seeds or spreading branches or pendent panicles only adds to present confusion. It is necessary first to define the major natural groups which agronomic and botanic studies have shown to exist, even if such groups can not always be sharply separated by a single character. When this has been done the varieties in each group should be distinguished by the most obvious natural characters. In this way only can we hope to prepare the usable and instructive systems of classification so much needed for the varieties of all our widely disseminated and variable cultivated crops.

SUMMARY.

AGRICULTURAL HISTORY AND DISTRIBUTION.

All cultivated sorghums are held to have been derived from the wild species *Andropogon halepensis*.

Many facts point to an independent origin in tropical Africa and in India, which are the two great centers of sorghum production, each occupied by an enormous number of varieties.

Sorghums, as crops cultivated for human food, date from the most remote historic times.

In varying forms sorghum is found abundantly throughout Africa and across the southern half of Asia. It is less abundantly distributed in southern Europe and in the United States and the West Indies.

Sorghum varieties furnish the chief cereal food of the native millions in Africa.

In British South Africa kafirs and sorgos are the predominating groups, represented by numerous varieties. Most of the kafirs and sorgos cultivated in the United States were obtained in this region, which is similar in many respects to much of our Great Plains area.

Throughout equatorial Africa some new and little-known groups, related to the durras, are the leading types. Forms of the Roxburghii group also occur commonly, while kafirs and sorgos are rare. All these tropical forms are late in maturing.

In Abyssinia and throughout the Sudan these new durra-like groups predominate. The Roxburghii group diminishes in importance, while kafirs and sorgos disappear as native types. Few of the local varieties are immediately adapted to our conditions.

In North or Mediterranean Africa only durra groups are found. Those forms found in Egypt are Sudanese; the white durra in the

Barbary States is nearly identical with that of southwestern Asia, and doubtless has resulted from the Arab invasion of Africa.

In all of southwestern Asia, including Asia Minor, Syria, Arabia, Turkestan, and perhaps a part of Persia, the single variety is a white durra, equivalent to our American form.

India contains a bewildering confusion of little-known forms. Many of them approximate the durra group; many are forms of shallu, the type of the Roxburghii group; while some represent entirely new groups of sorghum. A large number tested in this country have proved very poor yielders of grain.

East China and Manchuria are the home of a new group, the kowliangs, with several well-marked varieties. One sorgo variety has long been cultivated at the mouth of the Yangtze River. All these are well adapted to growth under the conditions obtaining in our sorghum belt.

The larger islands near the coast of Asia show a few forms, apparently derived from the mainland.

Europe received a sorghum variety from India during the first century, A. D. Only two or three forms of the sorgo type had been obtained, either through importation or evolution, up to about one hundred and thirty years ago. Only broom corn and a few sorgos are now found there.

No cultivated sorghums are native to the New World. Probably the earliest introduction was the Guinea kafir in the West Indies.

Scattering introductions have appeared in the United States since early colonial days. With the exception of broom corn, none was permanent until the arrival of the sorgo group about fifty-five years ago, followed by the durras and kafirs about twenty years later, shallu about twenty years ago, and the kowliangs recently.

BOTANICAL HISTORY AND CLASSIFICATION.

Sorghum was first known in Europe as *Milium indicum*, or Indian millet, in reference to its origin. Many similar names were applied later.

The common name sorghum, or sorgo, was derived more than three hundred and sixty years ago from the Latin word "surgo," meaning to rise or tower, in reference to the height of sorghums in comparison with that of other crops.

During the sixteenth, seventeenth, and eighteenth centuries the European forms were named and described, with occasional figures, by many pre-Linnean botanists.

The earliest accepted binomial is *Holcus sorghum* L., 1753.

By the middle of the nineteenth century fully thirty botanical species had been described from cultivated forms and about sixty binomial combinations had been made.

Only a part of these so-called species can be identified with existing available forms to-day.

Since about 1850 the differing forms of cultivated sorghums have been regarded as botanical or horticultural varieties. Descriptions have commonly been drawn from the heads and seeds only, ignoring the characters of the plant.

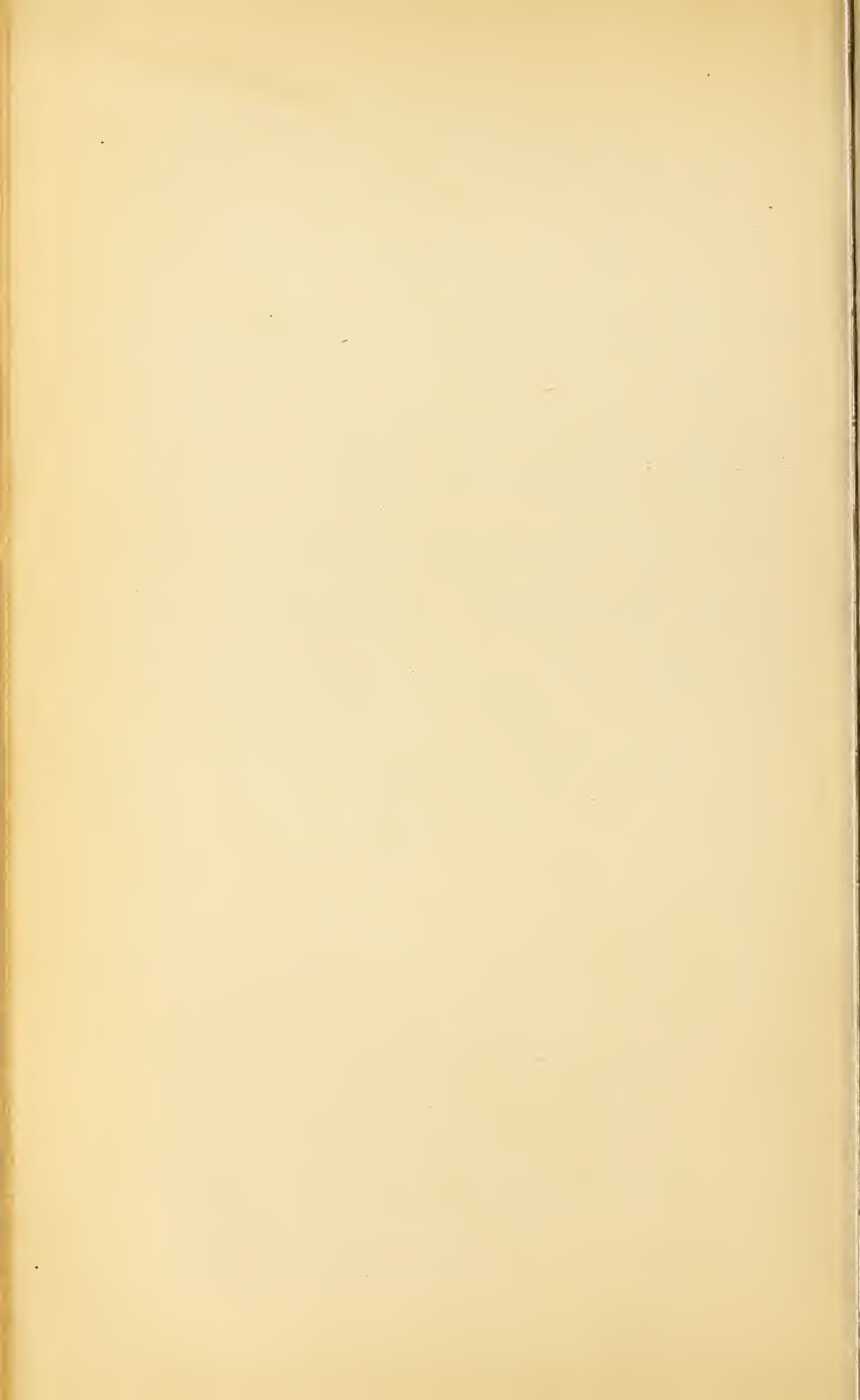
During the past half century numerous classifications of varying scope and completeness have been constructed. Any satisfactory classification must take account of the habit and characters of the entire plant and have regard for natural groups.

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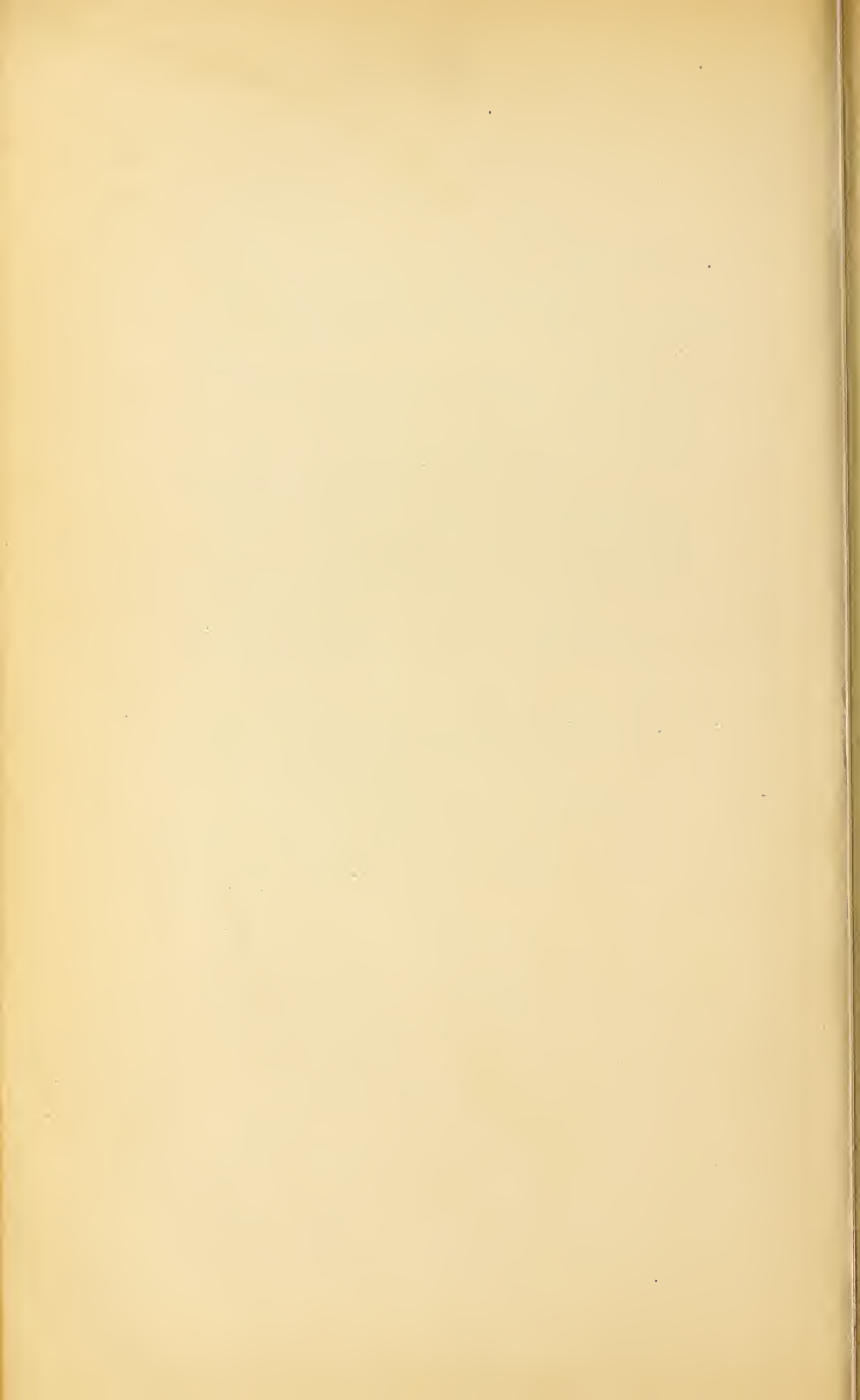
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